APPENDIX F

HILL AFB ENVIRONMENTAL SETTING

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This appendix contains an overview of the physical setting in which Hill AFB is located. Included are brief discussions of the geographic setting; geology; hydrogeology; hydrology; and climate, demography, and ecology of the Base.

Geographic Setting. Hill AFB is located immediately west of the Wasatch Mountains on the former Weber River delta. It is included in the East Shore hydrogeologic region of northern Utah, which consists of the east side of the Lake Bonneville Basin. The Wasatch Fault, which separates the Basin and Range from the Middle Rocky Mountain province, occurs a few miles east of the Base. Land forms in the Basin and Range are generally characterized by alternating, north trending block-faulted mountains and intermontane basins flanked by alluvial fans and outwash slopes. The local geomorphology and geology in the East Shore area were shaped by Lake Bonneville during the Pleistocene Epoch (from 2 million to 10,000 years ago). Lake Bonneville subsequently receded due to climatic changes and drainage through the Snake River leaving the Great Salt Lake.

Hill AFB occupies approximately 6,700 acres of a delta terrace of sediments deposited by the Weber River as it flowed into Lake Bonneville. The delta surface has slight to moderate relief with elevations varying from approximately 4,600 feet above sea level along the western boundary of Hill AFB to 5,045 feet above sea level along the eastern boundary. In contrast, the Wasatch Mountains, about four miles to the east, rise abruptly to an elevation of over 9,500 feet. The Great Salt Lake, about 12 miles west of Hill AFB, is presently at an elevation of 4,203 feet above sea level.

Local Geology. The surficial and near-surface geology of the East Shore area was mapped by Feth and others (1966) as unconsolidated deposits of gravel, sand, silt, and clay. These deposits are grouped into the Alpine and Provo Formations, deposited during the Alpine and Provo stages of Lake Bonneville. The Provo Formation, which overlies the Alpine consists of gravel and sand while the Alpine Formation is characterized by gravel, sand, clay, and silt with interbedded layers of fine sand and clay. The most distinctive feature of the Alpine Formation is a slabby salmon pink to reddish brown well-consolidated clay. The Provo Formation is generally 10 to 30-feet thick in the vicinity of Hill AFB, whereas sections of the Alpine Formation are 101 to 135 feet thick (Feth and others, 1966; USGS, 1988).

Differentiation between the Alpine and Provo formations in the vicinity of Hill AFB can be difficult due to wave action on the surface of the delta as the elevation of Lake Bonneville fluctuated. The surface sediments were eroded and redeposited, which produced an uneven erosional contact between the two formations. While the contact is not well defined, subsurface investigations at many Hill AFB locations have revealed coarser sandy silt and gravel deposits overlying silty clays and fine sands. These findings are consistent with the interpretations of Feth and others (1966) and the USGS (1988).

Hydrogeology. The East Shore hydrogeologic region of northern Utah is divided into several subdistricts based on hydrogeologic characteristics. Hill AFB is included in the Weber Delta subdistrict, which occupies about 140 square miles and is bounded by the Wasatch Mountains and the Great Salt Lake to the east and west, respectively. The northern and southern boundaries were determined based on changes in well yields. Although the Weber Delta subdistrict is underlain predominantly by fine-grained materials, large well yields have been observed. Despite the variability in the quality of ground water in the subdistrict, the water quality is generally good with low total dissolved solids and calcium to calcium-magnesium bicarbonate water types.

Usable quantities of ground water can be obtained from three primary aquifers in the Weber Delta subdistrict. The first is an unnamed, deep unconfined aquifer along the mountain front that is characterized by coarse-grained sediments. Sediments become finer and more stratified with distance from the mountains, where two deep, confined aquifers exist. These two aquifers, the Sunset and Delta, are considered the principal aquifers of the East Shore area. They occur at depths of approximately 250 to 400 feet and 500 to 700 feet below the ground surface, respectively. Shallow ground water also occurs in

flood plain deposits along stream channels, in isolated perched aquifers, and regionally in the valley lowlands within a few feet of the ground surface.

Ground water in the Weber Delta subdistrict generally flows from recharge areas along the front of the Wasatch Range toward the west and southwest to discharge areas along the Great Salt Lake. Recharge to the shallow aquifers occurs by seepage from the Weber River, streams, and canals; and by infiltration of precipitation and excess irrigation water. Recharge to the shallow aquifers also results from upward ground-water flow from underlying water-bearing units. Recharge to deeper, confined, aquifers occurs through subsurface inflow from fractures and joints in the consolidated rocks of the Wasatch Range and from under-flow from the deep unconfined aquifer near the mountain front. Most discharge from the principal aquifers is to wells, springs, and the shallow aquifers near the Great Salt Lake. Ground water in the shallow aquifers is discharged to drains, streams, and springs, and to the atmosphere through evapotranspiration.

Hydrology and Climate. The natural drainage patterns of Hill AFB have been altered over the years as the Base has developed. Surface water runoff is diverted into a series of ponds near the Base boundaries. The ponds retain the runoff until it evaporates or infiltrates into the ground. During heavy precipitation events, the retention ponds have overflowed into nearby storm sewers and natural drainages. The Davis-Weber canal runs around the outside perimeter of the east, north, and west sides of the Base and is used to transport and store irrigation water from April to October each year. The Davis-Weber canal is privately-owned and is not used to transport water to or from Hill AFB.

The climate in the vicinity of Hill AFB is temperate and semi-arid. Mean monthly temperatures are lowest in January, with an average maximum temperature about 31.8 degrees Fahrenheit (° F) and an average minimum temperature of 21.7° F. The highest temperatures occur during July when maximum temperatures average about 82.5° F and the minimum average is 63.9° F. The frost-free growing season is from May through September. The average annual precipitation recorded during the period 1978 to 1990 at a gauging station located in Riverdale (one-half mile northeast of the Base) was 19.8 inches. The majority of precipitation falls from October though May. May is usually the wettest month, and June and July are the driest months. Average annual evaporation is approximately 45 inches of water per year. Winds at Hill AFB are predominantly from the east and south at generally less than 10 miles per hour.

Population. The Hill AFB area is part of the Wasatch Front, which is generally defined by Weber, Davis, Morgan, Salt Lake, Utah, and Tooele counties. The Wasatch Front comprises the geographic area along the west slope of the Wasatch Mountains. The Wasatch Front has seen rapid population growth in recent years; during the period from 1970 to 1995, the combined population of Weber, Davis, Morgan, Salt Lake, and Tooele counties grew from an estimated 710,000 to 1.24 million, an increase of 75 percent. The estimated 1995 combined population of Davis and Weber Counties was 392,000, which showed an increase of 76 percent over 1970. Communities adjacent to the Base are Clearfield, Layton, Sunset, Clinton, Roy, South Weber and Riverdale, collectively have a population of about 185,000. Table F-1 presents the regional population figures beginning in 1970 and includes population projections through the year 2005.

Housing and commercial development have increased commensurate with this population growth in areas adjacent to Hill AFB. The period between 1970 and 1985 saw a 69 percent increase in the number of housing units in Weber and Davis Counties, resulting in a total of 102,000 units by 1985.

Employment. Total employment along the Wasatch Front area has generally kept pace with the population growth. During the period of 1970-1995, total employment in the region grew from an estimated 264,000 to 475,000 jobs. Weber and Davis Counties showed a combined 60 percent jobs increase during this 15-year period. Government (federal, state, and local) is the largest single employer in these counties (as well as the State of Utah overall), comprising 53 and 27 percent of employment in Davis and Weber Counties, respectively, and 22 percent of state-wide employment. The economic base of these counties is heavily dependent on federal employment, and Hill AFB is a major employer. Other large employers, such as Eimco, Kennecott Utah Copper Division, and Alliant now employ several hundred people in the area, but the majority of the region's non-government employment is in small or medium industry and businesses.

Land Use. Surrounding land use is varied, and includes uses as diverse as agriculture and heavy industry. In general, areas to the west of the Base are highly developed

with a high population density, while the areas east of the Base contain large open and agricultural tracts. Lands to the north, northeast, and south show intermediate levels of development, with residential and business/light industry distributed among open tracts of land.

Flora. Hill AFB is located in a geographic region that would typically support a mountain-brush type native plant community. Dominant vegetation in this plant community includes scrub oak (*Quercus gambelii*), big sagebrush (*Artemesia tridentata*), rabbit brush (*Chrysothamus* sp.), and western wheatgrass (*Agropyron smithii*). However, much of Hill AFB has been developed, and the area is populated by introduced species. Only a small remnant of the native plant community occurs at the northern portion of the Base. Other micro environments also occur at Hill AFB. One such environment is the storm-water retention basins that support vegetation associated with wetlands including sedge grasses (*Carex* sp.), sandbar willow (*Salix exigua*), and cattails (*Typha latifolia*) (Hill AFB, 1989). Although Hill AFB supports a broad variety of plant life, currently no threatened or endangered plant species have been identified. The *Natural Resource Management Plan for Hill Air Force Base, Utah* provides a complete listing of the flora found on Base (Hill AFB, 1989).

Fauna. The wildlife found at Hill AFB are common to mountain-brush habitat and the western United States. Wildlife are most frequently found in the relatively undisturbed northern area of the Base. Wildlife in this area consists of a variety of large and small mammals, birds, amphibians and reptiles. Common residents include: mule deer (*Odocoileus hemionus*), fox (*Vulpes vulpes*), coyotes (*Canis latrans*), mice (*Peromyscus* sp.), shrews (*Sorex* sp.), weasels (*Mustela frenata*), cottontail (*Sylvilagus nuttalli*) and jack rabbits (*Lepus* sp.), lizards, pheasants (*Phasianus colchicus*), meadow larks (*Sturnella neglecta*), horned larks (*Eremophilia alpestris*), magpies (*Pica pica*), and killdeers (*Charadrius vociferus*). Wildlife species found in the wetlands include mallard ducks (*Anas platyrhynchos*) and great blue herons (*Ardea herodias*). Two endangered species, the American bald eagle (*Haliaeetus leucocephalus*) and the peregrine falcon (*Falco peregrinus*), may use Hill AFB. Bald eagles from the northern latitudes winter along streams and lakes throughout Utah and have been observed at the Weber River just north of the Base. Peregrine falcons have been reintroduced in the marshes along the Great Salt Lake and also could be occasional visitors to the area. Aside from these two species, no threatened or endangered species have been identified at Hill AFB.

TABLE F-1

REGIONAL POPULATION TRENDS AND PROJECTIONS

	1970	1980	1985	1990	1995	2000	2005
State of Utah	1,059,273	1,474,000	1,665,600	1,722,950	1,957,700	2,130,000	2,343,100
Wasatch Front Region (a)	709,441	941,195	1,051,854	1,104,400	1,237,500	1,337,800	1,465,800
Davis County	99,028	147,509	171,261	187,900	215,400	236,000	259,300
Weber County	124,130	139,890	157,525	158,300	176,600	196,700	210,400

Source: Wasatch Front Regional Council (January 1996)(Projections rounded to nearest 100 persons)

(a) Participating Counties: Davis, Weber, Morgan, Salt Lake, and Tooele